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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/699,456	10/31/2003	David Champion	100200584-1	9588

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EXAMINER	
ONEILL, KARIE AMBER	

ART UNIT	PAPER NUMBER
1795	

NOTIFICATION DATE	DELIVERY MODE
11/18/2009	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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Office Action Summary	Application No.	Applicant(s)	
	10/699,456	CHAMPION ET AL.	
	Examiner	Art Unit	
	Karie O'Neill	1795	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *15 July 2009*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-20,48,49 and 68-72* is/are pending in the application.

4a) Of the above claim(s) *5 and 7-11* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-4, 6, 12-20, 48-49, 68-72* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

1. The Applicant's amendment filed on July 15, 2009, was received. None of the claims have been amended. Claims 21-47 and 50-67 have been cancelled. Claims 5, 7-11 have been withdrawn from consideration. Therefore, Claims 1-4, 6, 12-20, 48-49 and 68-72 are pending in this office action.

2. The text of those sections of Title 35, U.S.C. code not included in this action can be found in the prior Office Action issued on April 16, 2009.

Claim Rejections - 35 USC § 103

3. The rejection of Claims 1-4, 6, 12, 15-20, 48, 49 and 68-71 under 35 U.S.C. 103(a) as being unpatentable over Seabaugh et al. (US 2003/0027033 A1) in view of Zhou et al. (US 2003/0180472 A1) are maintained. The rejection is repeated below for convenience.

With regard to Claims 1-3, 20, 48, 49 and 71, Seabaugh et al. discloses a solid oxide fuel cell in which power is generated by the transport of ions through an electrolyte membrane sandwiched between electrodes (paragraph 0003). The electrolyte acts as a substrate for a ceramic electrode, the ceramic electrode comprising a mixture of two or more components including at least one nano-scale ionically conducting ceramic electrolyte material and at least one nano-scale powder of an electrode material (paragraph 0002). The electrode/electrolyte material mixture is established on either side of the electrolyte material when forming the fuel cell. The

electrode/electrolyte material mixture is made up of the mixture of electrolyte nanoparticles and electrode material nanoparticles being mixed together with a liquid surfactant material that will surround and contain the powdered mixture. The plurality of nanoparticles enhances catalytic activity of the electrode as the oxygen molecules from air are converted to oxygen ions at the air electrode and these oxygen ions react with hydrogen and carbon monoxide to form water and carbon dioxide at the fuel electrode (see paragraphs 0003-0004 and Claims 1-25). Seabaugh et al. also discloses wherein the fuel cell is device for generating power which is supplied to external devices or a load.

Seabaugh et al. does not disclose wherein the film established on the substrate is a patterned film including soluble matter of an imaged photoresist having a plurality of nanowires dispersed therein, at least one of the plurality of nanowires contacting at least an other of the plurality of nanowires.

Zhou et al. discloses a method for assembling nano-objects into patterned structures onto a supporting surface. These nano-object structures are useful in a variety of devices including fuel cells (paragraph 0018). The nano-objects include nanoparticles, nanotubes, nanorods or nanowires having a dimension that is less than 1 micron in at least one direction (paragraph 0004). Zhou et al. discloses in Figures 8A and 8B and paragraphs 0061-0063, an electrode for use in a fuel cell comprising a multi-layer structure. The first layer is formed from self-assembled carbon nanotubes (810A, 840) which are deposited on a conducting surface (830). The second layer (820A, 850) is an electrolyte material deposited over the self-assembled carbon

nanotubes using any suitable technique. The term "self-assembled" implies that the nanotubes will contact at least an other of the nanotubes and inherently will increase the number of sites per unit volume in which catalysis takes place. In Figure 9A and paragraphs 0065-0066, Zhou et al. discloses the method of making the patterned substrate by spin-coating a thin layer of photoresist on a substrate and submersing it into a solution of nano-objects/water, wherein when the water evaporates the nano-objects, or insoluble material of the photoresist, are present. This method can be used to make the multi-layer nano-object structures for use in the fuel cell electrodes of Figures 8A and 8B. Therefore, based on the teachings of the references, it would have been obvious to one of ordinary skill in the art to use a patterned film, including insoluble matter of an imaged photoresist having a plurality of nanowires dispersed therein, on the substrate of the fuel cell of Seabaugh et al., because Zhou et al. teaches that imaged photoresist techniques can form an electrode for use in a fuel cell in a variety of patterns including squares, circles, dots or any other geometry that can be patterned and the process forms multilayer structures with a desired thickness and desired number of repeating layers.

With regard to Claim 4, Seabaugh et al. discloses wherein the electrolyte is at least one of yttrium-stabilized zirconia, gadolinium-doped ceria, a doped ceria electrolyte material, barium zirconate, scandium doped zirconia, a lanthanum gallate based ceramic electrolyte material, a bismuth oxide based electrolyte materials (paragraph 0051). Gadolinium-doped ceria is formed as a single phase with a cubic

fluorite structure as is evidenced by Godinho in Influence of Microwave Heating on the Growth of Gadolinium-Doped Cerium Oxide Nanorods on page 384.

With regard to Claims 6, 12 and 15-19, Zhou et al. discloses wherein the nanowires are formed from an electrolyte filament material (paragraph 0061) and wherein the patterned film comprises an electrode (840, 860), which is either a cathode or anode (Figure 8B). Zhou et al. discloses wherein the nanowires are "self-assembled" meaning that they are randomly oriented throughout the patterned film and have a diameter between 0.4nm and 50 nm and a length between 0.1μm and 100μm (paragraph 0013). It would have been obvious to one of ordinary skill in the art to use nanowires randomly oriented throughout the patterned film of a the cathode of Seabaugh et al., because Zhou et al. teaches the nanowires have exceptional mechanical properties with high elastic modulus, high ductility, high electrical and high thermal conductivity, thermal stability and chemical stability (paragraph 0013). These features, especially high electrical conductivity and thermal and chemical stability are essential for fuel cell applications.

With regard to Claim 68, Seabaugh et al. discloses that the ceramic electrode material formed by mixing at least one nano-scale ionically conductive ceramic electrolyte material and at least one nano-scale powder of an electrode material, are useful in fuel cells. Zhou et al. discloses the patterned film including insoluble matter of an imaged photoresist, for use in fuel cells. The combined fuel cell of Seabaugh et al. and Zhou et al. and the instant application have the same structural features and the ceramic electrode material can be used in the same type of fuel cell.

With regard to Claims 69-70, Zhou et al. discloses in Figures 8A and 8B, wherein the plurality of electrolyte filament carbon nanowires (810A, 840) is deposited on a substrate (830) and subsequently coated by a second material (820A, 850) of polymers, metals, ceramics, semiconductors, inorganic materials, organic materials or the like (paragraph 0061). It would have been obvious to one of ordinary skill in the art at the time of the invention to combine the nanowires with cathode material nanoparticles in the fuel cell of Seabaugh et al., because Zhou et al. teaches forming a multilayer structure with a desired thickness having high mechanical strength that can be used in a fuel cell (paragraphs 0061-0063). Further, Zhou et al. teaches the nanowires have exceptional mechanical properties with features, such as high electrical conductivity and thermal and chemical stability that are essential for fuel cell applications.

With regard to Claim 72, Zhou et al. discloses wherein the imaged photoresist is a negative photoresist or a positive photoresist. Zhou et al. discloses that a photo mask with periodic lines is placed on top of the surface coated with the photoresist. After placement of the photo mask, an ultraviolet light source is used to expose the surface. The developed glass forms a patterned substrate with periodic hydrophobic regions which are covered by the photoresist and hydrophilic regions which are free of the photoresist (paragraph 0065). It would have been obvious to one of ordinary skill in the art to make the imaged photoresist a negative photoresist or a positive photoresist in the fuel cell of Seabaugh et al., based on the desired fuel cell application, such as an anode catalyst layer or a cathode catalyst layer. Further, Zhou et al. teaches a process

of forming patterns in any geometry or hydrophilicity or hydrophobicity as needed (paragraph 0066).

4. The rejection of Claims 1-3, 6, 12-20, 48, 49 and 68-72 under 35 U.S.C. 103(a) as being unpatentable over Huang et al. (US 2002/0098406 A1) in view of Zhou et al. (US 2003/0180472 A1) are maintained. The rejection is repeated below for convenience.

With regard to Claims 1-3, 20, 48, 49 and 71, Huang et al. discloses a solid oxide fuel cell for automotive and other applications (paragraph 0008), comprising: a substrate made of an electrolyte (Example 1); an inherently patterned paste made up of a plurality of well-dispersed nano-sized particles of electrocatalytic noble metals and ceramic ionic conducting particles mixed with a suitable binder and a suitable solvent, the plurality of well-dispersed nano-sized particles established on the electrolyte substrate and increasing the number of sites which enhance catalytic activity (paragraphs 0020-0023, 0043).

Huang et al. does not disclose wherein the film established on the substrate is a patterned film including soluble matter of an imaged photoresist having a plurality of nanowires dispersed therein, at least one of the plurality of nanowires contacting at least an other of the plurality of nanowires.

Zhou et al. discloses a method for assembling nano-objects into patterned structures onto a supporting surface. These nano-object structures are useful in a variety of devices including fuel cells (paragraph 0018). The nano-objects include

nanoparticles, nanotubes, nanorods or nanowires having a dimension that is less than 1 micron in at least one direction (paragraph 0004). Zhou et al. discloses in Figures 8A and 8B and paragraphs 0061-0063, an electrode for use in a fuel cell comprising a multi-layer structure. The first layer is formed from self-assembled carbon nanotubes (810A, 840) which are deposited on a conducting surface (830). The second layer (820A, 850) is an electrolyte material deposited over the self-assembled carbon nanotubes using any suitable technique. The term "self-assembled" implies that the nanotubes will contact at least an other of the nanotubes and inherently will increase the number of sites per unit volume in which catalysis takes place. In Figure 9A and paragraphs 0065-0066, Zhou et al. discloses the method of making the patterned substrate by spin-coating a thin layer of photoresist on a substrate and submersing it into a solution of nano-objects/water, wherein when the water evaporates the nano-objects, or insoluble material of the photoresist, are present. This method can be used to make the multi-layer nano-object structures for use in the fuel cell electrodes of Figures 8A and 8B. Therefore, based on the teachings of the references, it would have been obvious to one of ordinary skill in the art to use a patterned film, including insoluble matter of an imaged photoresist having a plurality of nanowires dispersed therein, on the substrate of the fuel cell of Seabaugh et al., because Zhou et al. teaches that imaged photoresist techniques can form an electrode for use in a fuel cell in a variety of patterns including squares, circles, dots or any other geometry that can be patterned and the process forms multilayer structures with a desired thickness and desired number of repeating layers.

With regard to Claims 6, 12 and 15-19, Zhou et al. discloses wherein the nanowires are formed from an electrolyte filament material (paragraph 0061) and wherein the patterned film comprises an electrode (840, 860), which is either a cathode or anode (Figure 8B). Zhou et al. discloses wherein the nanowires are "self-assembled" meaning that they are randomly oriented throughout the patterned film and have a diameter between 0.4nm and 50 nm and a length between 0.1μm and 100μm (paragraph 0013). It would have been obvious to one of ordinary skill in the art to use nanowires randomly oriented throughout the patterned film of a the cathode of Huang et al., because Zhou et al. teaches the nanowires have exceptional mechanical properties with high elastic modulus, high ductility, high electrical and high thermal conductivity, thermal stability and chemical stability (paragraph 0013). These features, especially high electrical conductivity and thermal and chemical stability are essential for fuel cell applications.

With regard to Claims 13-14, Huang et al. discloses wherein the inherently patterned paste comprises a cathode, wherein the plurality of nano-sized electrocatalytic noble metal particles are metallic components of cathode material (Example 1), and wherein the cathode metallic comprise at least one of platinum, palladium, rhodium, silver, ruthenium, gold, iridium, osmium or combinations or mixtures thereof (paragraph 0030).

With regard to Claim 68, Huang et al. discloses an inherently patterned paste made up of a plurality of well-dispersed nano-sized particles of electrocatalytic noble metals and ceramic ionic conducting particles being useful in fuel cells. Zhou et al.

discloses the patterned film including insoluble matter of an imaged photoresist, for use in fuel cells. The combined fuel cell of Huang et al. and Zhou et al. and the instant application have the same structural features and can be used in the same type of fuel cell. Applicant is advised to submit other information in regard to a single chamber fuel cell if it is shown to be patentably distinct to the invention.

With regard to Claims 69-70, Zhou et al. discloses in Figures 8A and 8B, wherein the plurality of electrolyte filament carbon nanowires (810A, 840) is deposited on a substrate (830) and subsequently coated by a second material (820A, 850) of polymers, metals, ceramics, semiconductors, inorganic materials, organic materials or the like (paragraph 0061). It would have been obvious to combine the nanowires with cathode material nanoparticles in the fuel cell of Huang et al., because Zhou et al. teaches forming a multilayer structure with a desired thickness having high mechanical strength that can be used in a fuel cell (paragraphs 0061-0063).

With regard to Claim 72, Zhou et al. discloses wherein the imaged photoresist is a negative photoresist or a positive photoresist. Zhou et al. discloses that a photo mask with periodic lines is placed on top of the surface coated with the photoresist. After placement of the photo mask, an ultraviolet light source is used to expose the surface. The developed glass forms a patterned substrate with periodic hydrophobic regions which are covered by the photoresist and hydrophilic regions which are free of the photoresist (paragraph 0065). It would have been obvious to one of ordinary skill in the art to make the imaged photoresist a negative photoresist or a positive photoresist in

the fuel cell of Huang et al., because Zhou et al. teaches a process of forming patterns in any geometry or hydrophilicity or hydrophobicity as needed (paragraph 0066).

Response to Arguments

5. Applicant's arguments filed July 15, 2009, have been fully considered but they are not persuasive.

Applicants respectfully disagree with the "term 'imaged photoresist' describing a process in which a patterned film is formed on a substrate and thus is a product-by-process limitation that is not given patentable weight.

The product-by-process portion of the rejection has been overcome based on the explanation given on page 8 of the Remarks and in Exhibit A.

Applicant argues that the Zhou reference, "does not teach generating a patterned film which includes the insoluble photoresist material, rather he teaches the use of a photoresist as a photo mask (see paragraph [0065]) for depositing the nano-objects in a desirable pattern. In Zhou, the photoresist is essentially a masking layer for subsequent deposition steps, and all of the photoresist material is ultimately removed."

In Figure 9A of Zhou, it is taught in paragraph 0065, that a patterned glass substrate is formed with periodic hydrophobic regions that are covered with photoresist and hydrophilic regions which are free of the photoresist. The substrate is immersed into a SWNT/water suspension, which would allow for the nanowires to be dispersed in the already present photoresist material. After development/imaging occurs, SWNT form on the hydrophilic regions which are free of photoresist, but insoluble photoresist

material is still present on the hydrophobic regions, as well as the nanowires. In the following paragraph 0066, the substrate is washed in a suitable solvent in order for the "remaining photoresist" to be removed. This indicates that after the first development/imaging occurs, insoluble photoresist material is still present on the substrate, along with the nanowires. It is also noted that before the substrate is washed with a solvent, the insoluble photoresist material and the nanowires are present in an intermediate form. "Where the products produced by the reference process are neither transitory nor ephemeral but are by nature tangible and permanent pending the subsequent treatment to which they are subjected. It is held that such products, though intermediate, in the reference, are anticipatory of the product defined by the claims on appeal." *Ex parte Brinto*n, 82 USPQ 112. Therefore, Zhou meets the claim limitation of a "patterned film including insoluble matter of an imaged photoresist having a plurality of nanowires dispersed therein".

Applicant further argues that Examiner is incorrect when stating, "when the water evaporates, the nano- objects, or insoluble material of the photoresist, are present". Applicant asserts that "when the water evaporates, both the nano-objects and the insoluble material are present, but the nano-objects are established "on the hydrophilic region of the glass slide" (i.e., the regions that are free of the photoresist, see paragraph [0065]), and thus are next to the hydrophobic regions which are covered with photoresist. Once the remaining photoresist is removed, the structure of Zhou contains nano- objects and NO photoresist."

Once again, paragraph 0066 of Zhou states that after the first development/imaging step occurs, photoresist material is still present and is subsequently removed by a second washing in a suitable solvent. If the second washing does not occur, the insoluble photoresist material is still present on the glass substrate, in an intermediate form. . "Where the products produced by the reference process are neither transitory nor ephemeral but are by nature tangible and permanent pending the subsequent treatment to which they are subjected. It is held that such products, though intermediate, in the reference, are anticipatory of the product defined by the claims on appeal." *Ex parte Brinto*n, 82 USPQ 112.

Applicant argues that, "assuming arguendo that one skilled in the art was to include Zhou's photoresist with Seabaugh's composite, based on the teachings of Zhou, it is submitted that the photoresist would be removed from the composite, and no nano-objects (other than the particles taught by Seabaugh) would be present in the composite. As such, any film resulting from the combination of Zhou and Seabaugh would not be the same as Applicants' recited patterned film, at least because the insoluble photoresist matter would not be present in the electrode."

It is stated above that the insoluble photoresist material of Zhou would be present on the glass substrate. Since the insoluble photoresist material is present in Zhou, it would be present in the combination of Zhou and Seabaugh. Applicant's argument is not persuasive.

Finally, Applicant argues that, "assuming arguendo that one skilled in the art was to include Zhou's photoresist with Huang's particle mixture, based on the teachings of

Zhou, it is submitted that the photoresist would be removed from the mixture, and no nano-objects (other than the particles taught by Huang) would be present in the resulting film. As such, any film resulting from the combination of Zhou and Huang would not be the same as Applicants' patterned film, at least because the insoluble photoresist matter would not be present in the electrode."

It is stated above that the insoluble photoresist material of Zhou would be present on the glass substrate. Since the insoluble photoresist material is present in Zhou, it would be present in the combination of Zhou and Huang. Applicant's argument is not persuasive.

Conclusion

6. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Karie O'Neill whose telephone number is (571)272-8614. The examiner can normally be reached on Monday through Friday from 8am to 5pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Patrick Ryan can be reached on (571) 272-1292. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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KAO